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The relationships among milk yield, milk composition, insulin- like growth factor-1 and prolactin in lactating Egyptian buffaloes heifers

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ABSTRAT:

Twenty Egyptian buffaloes were housed in shaded open yards and maintained under the same managerial and environmental conditions. Buffaloes were divided into two groups at the end of the first lactation season according to their lactation period (LP). The first group (G1) was lactated more than seven months (225 days on average) and the second group (G2) was lactated less than seven months (175 days on average).

Milk samples were collected once weekly for each lactating buffalo at 6:00 AM and 6:00 PM and then mixed. Prolactin (PRL) and Insulin- like growth factor-1 (IGF-1) were determined during lactation period. There was a significant difference between G1 and G2 but there was non-significant difference between the stage average and the same trend was recorded in milk fat (F%). On the other hand there was a significant different in sold not fat (SNF%) in stage average.

There was a high positive and significant correlation among milk yield and total solids (T.S %), F % and water (%). There was positive and significant correlation among milk yield, S.N.F (%) and Lactose (%).in the two lactating groups (G1 and G2). It was noticed that the concentration of IGF-1 was higher in G1 than that in G2 during the three stages of lactation by 40.21, 22.35 and 12.86 (%), respectively. PRL concentration in G1 was slightly higher in early and mid-lactation than that in the late lactation. There was a positive and significant correlation among PRL and T.S, Fat and water. There was high positive significant correlation among IGF-1, T.S, SNF, Ash, lactose and water.

KEYWORDS: Egyptian buffaloes, insulin like growth factor-1, prolactin, milk production and composition, lactation stages.

1. INTRODUCTION:

The Main objective of dairy farming is to get optimum milk production and earn a profitable income. Understanding the lactation cycle, variations in composition at different stages and feeding dairy animals with a balanced ration are very much important for a dairy farmer to run a successful dairy farm.

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The Egyptian buffaloes (Bubalus bubalis) belong to the river type. They were brought to Egypt during the middle of the 7th century from India, Iran and Iraq (Moioli and Borghese, 2005).Water buffaloes (Bubalus bubalis) are considered the main dairy animal and the most important dairy species in South American, African, Asian, and Mediterranean countries, including Egypt (Hernández-Castellano et al. 2019). Water buffalo milk comprises approximately 70 % of the annual milk production in Egypt (Abou-Bakr 2009; Du et al. 2020), and is the second most consumed milk worldwide (Freitas et al.2020) This milk is preferred by the Egyptian consumer due to its white color, acceptable flavor, and high fat percentage compared to cows (El-Salam and El-Shibiny 2011). According to FAOSTAT (2020) the buffalo population in Egypt has decreased from 3445177 heads in 2018 to about 1671378 heads in 2020. Averages of daily milk yield (DMY) in buffaloes were 3.97 kg (Abou zeina et al., 2009). The percentage of total solid (TS) in lactating buffaloes was 13.37 % and 12.13 % in early and mid-lactation, respectively (Gurmessa and Melaku 2012). The average of fat (F) % in lactating buffaloes was 6.38% (Gurmessa and Melaku 2012). The percentages of lactose (L) % in lactating buffaloes were 4.19 and 4.21% respectively Seema and Quazi (2014). The percentages of milk ash in lactating buffaloes were 0.64 %, 0.72 % and 0.72% in early, mid and late stage of lactation respectively (Seema and Quazi 2014). Nixon et al (2009) found that within breed, individual-level correlations between random effect solutions at knot-points showed that daily milk yield (DMY) was positively correlated with milking frequency. Positive correlations between yield and milking frequencies were previously reported both as genetic and as permanent environmental correlations obtained in automatic milking systems herds. Miller et al. (2006) found that prolactin (PRL) concentration was higher in early lactation than that in late lactation. Jyotsna and Mahendra (2010) found that fat, protein and lactose during the lactation period from early to late lactation were increased. Hassan et al (2014) reported that the concentration of insulin like growth factor-1 (IGF-1) increased as lactation advanced. Aamrapali (2021) reported that PRL is involved in the development and differentiation of mammary gland. Blocking the prepartum release of PRL in dairy cows with the specific drug resulted in 40 to 50% reduction in subsequent milk production and this effect was overcomed by simultaneous administration of exogenous PRL.

The objectives of this study were to study the relation among milk yield, milk composition, Insulin- like growth factor-1 and prolactin during the different lactation stages and to determine the possibility of using these relations to predict milk yield and its composition in lactating Egyptian buffaloes under hot conditions of Egypt.

2. MATERIALS AND METHODS:

The experimental work of this study was carried out from September 2018 to June 2019 at the Experimental station of Animal Production, Faculty of Agriculture, Fayoum University, Fayoum, Egypt.

Experimental animals:

Twenty Egyptian buffaloes heifers in first lactation season were divided into two groups at the end of the first lactation season according to their previous lactation period (LP). The first group (G1) buffaloes were lactated more than seven months (225 days on average) and the second group (G2) buffaloes were lactated less than seven months (175 days on average). Buffaloes were housed in shaded open yards and maintained under the same managerial and environmental conditions. Animals were fed individually according to NRC (2001). The nutrient requirements were adjusted according to the buffalo`s live body weight (BW), and subsequent milk production of each buffalo. Buffaloes were milked manually twice daily at 6:00 AM and 6:00 PM. The experimental work was lasted until the buffaloes stop lactation. Daily milk yield (DMY, Kg), weekly milk yield (WMY, Kg) and lactation period (LP/day) were recorded for each buffalo alongside. Lactation period was divided into three stages being early, mid and late lactation according to Metry et al. (1994).

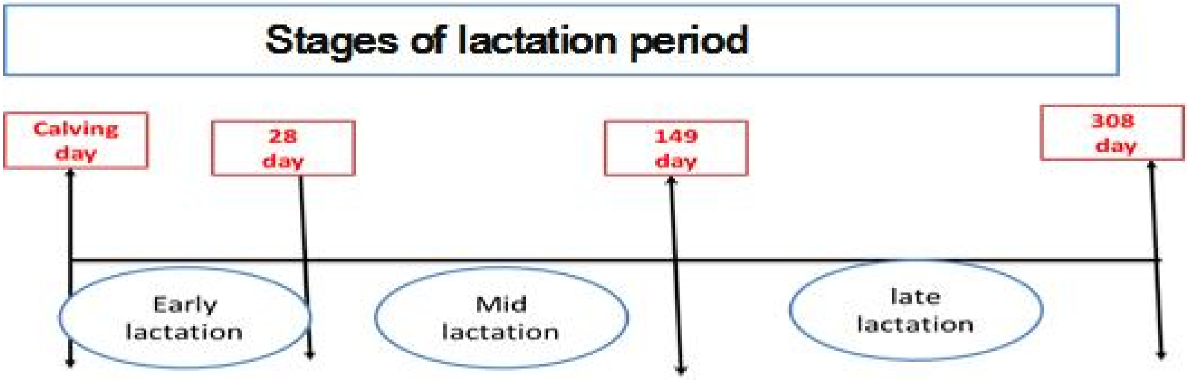

Fig .1. lactation stages of Egyptian buffaloes.

Experimental procedures

Milk sampling and analysis:

Milk samples (30 mg) were kept frozen at (-20°C) until the chemical analysis was executed. Percentages of fat (F,%), lactose (L,%), protein (P,%), total solids (TS,%), water content (%), solids not fat (SNF%) were quantified by Ekomilk® analyzer (KAM 98-2A USA) at the time of collecting the samples.

Assessment of relevant blood hormones:

Special commercial kits were used to quantify prolactin (PRL) and insulin like growth factor-1 (IGF-1) hormones in blood plasma according to the procedures outlined by the manufactures. These two hormones were determined during lactation period. Immunoradiometric assay (IRMA) technique was used to quantify plasma PRL and IGF-1 by shin medicsinc (riakey prolactin irma tube USA).

Statistical analysis:

General linear model procedure according to SPSS 21 (2012) was used for the statistical analysis of milk yield, milk composition and blood hormones during the experimental period using the following model:

$$Y_{ijk} = \mu + P_i + A(P)_{ik} + G_j + (P*G)_{ij} + e_{ijk}$$

Where ,

Yijk = Any observation of k^{th} animals within j^{th} group within i^{th} experimental period.

µ = Overall mean

Pi = Effect of i^{th} period (I = lactation stage)

A(P) ik= the repeated of k^{th} animals within i^{th} experimental period.

Gj = Effect of j^{th} group (j = 1-2, 1 = G1, 2= G2)

(P*G)ij = The interaction between experimental periods and groups.

eijk = Experimental error.

Duncan's multiple range tests were used to compare the differences among means (Duncan's, 1955). Phenotypic correlations were estimated using SPSS (2012) program.

3. RESULTS AND DISCUSSION

Milk yield (kg/d):

The average of total milk yield (TMY kg) was significantly higher in G1than that in G2 by 36.22% Table (1).This result was lower than that recorded by Pawar et al. (2012) who found that the average of TMY in buffaloes was1576 kg. Weekly milk yield (WMY) was higher in G1 than in G2by 24.13%, and the same trend was recorded in DMY that was higher by 24.12%and LP was higher by 32.1%.

The average of DMY of lactating Egyptian buffaloes in the present study was higher in G1than that recorded by Abou Zeina et al. (2009) who found that the average of DMY in buffaloes was 3.97 kg but it was lower than that recorded by Farouk (2012) who reported that the average of DMY in buffaloes was 4.5 liters. These results were higher than that reported by Siddiquee et al (2010) who found that the average of daily milk yields were 2.11 and 2.5 liters, respectively for Trishal and Companiganj whereas the peak daily milk yields were 5.03±0.678 and 9.06±1.297 liters, respectively for Trishal and Companiganj and the lowest daily milk yields were 0.75±0.391 and 1.50±0.717 liters, respectively for that regions.

The average of LP of lactating Egyptian buffaloes is shown in Table (1). The average of LP in the present study was significantly higher in G1 than that recorded in G2 by 32.1%. These results are lower than the results of Hussen (1990) who found that the average of LP was 328.98± 28.57 days with lactation yields of 730.9±153.65 kg /lactation. The lowest DMY was observed to be 1 liter and the highest DMY was 5 liters with an average DMY of 2.32±0.63 liters. Mudgal (1987) found that Murrah herds yielded on an average of 1975 liters in a lactation period of 338 days and Nil-Ravi yielded up to 4500 liters or about 10 liters per day. Guglielmetti (2007) reported that in the Chursdorf herd over a 305-day lactation period, milk yield was2232 kg on average in the first lactation and of2577 kg in the second lactation.

The higher weekly milk yield (WMY) was recorded at mid lactation in G1 and G2. This result agree with that of Qureshi et al (2007) who found that the reduction in high yielding buffaloes was slight up to the 16th week but later on it decreased. In the medium producing buffaloes, the reduction was the least while in the low producing buffaloes the reduction was moderate. The little decline in the low yielding buffaloes was due to the less milk yield in these animals.

The average DMY of both groups during different lactation stages are presented in Table (3). In this study, the maximum DMY was recorded during the mid-lactation period. It was higher by 32.26% and 30.85% in G1 and by 62.76% and 105.72% in G2 than those in early and late lactation period respectively. Regardless of groups the highly significant DMY was recorded in mid lactation period and it was higher than early and late lactation periods by 43.45% and 55.48%, respectively.

Table 1. daily milk yield (DMY), weekly milk yield (WMY), total milk yield (TMY) and lactation period (LP), in Egyptian buffaloes heifers during the whole experimental period (Means ± SE).

Groups	DMY (kg/d)	WMY (kg/w)	TMY(kg/d)	LP (days)
G1	4.17 ± 0.29	29.17 ± 2.06	1053.40^{a} ± 46.47	228^{a} ± 3.95
G2	3.36 ± 0.3	23.50 ± 2.08	773 ^{b} ± 18.27	172 ^{b} ± 3.05
Average	3.77 ± 0.3	26.33 ± 2.07	913.2 ± 32.37	200 ±3.5

^{a} and ^{b} Means with different superscipts in the same coulm are significantly different (P ≤ 0.01).
G1 = Group that milked more than7 months and G2= Group that milked less than 7 months.

Table 2. Weekly milk yield (kg) **during the three different stages of lactation in Egyptian buffaloes heifers (mean ± S.E)**

Groups	Stages of lactation		
	Early	Mid	Late
G1	26.43 ± 6.95	34.54 ± 6.34	26.53 ± 8.89
G2	20.55^{b} ± 5.02	33.09^{a} ± 2.44	16.87^{b} ± 3.8
Average	23.49^{B}±2.06	33.82^{A}±1.45	21.7^{B}±2.6

G1 = group that milked more than 7 months and G2= group that milked less than 7 months.
^{a} and ^{b} Means with different superscipts in the same row are significantly different (P ≤ 0.01).
^{A} and ^{B} Means with different superscipts in the same row are significantly different (P ≤ 0.01).

Table 3. daily milk yield during the three different stages of lactation in Egyptian buffaloes heifers (mean ± S.E)

Groups	Stages of lactation		
	Early	Mid	Late
G1	3.72 ^{NS} ± 0.43	4.92 ^{NS} ± 0.42	3.76^{NS}± 0.52
G2	2.90 ^{NS} ± 0.34	4.72 ^{NS} ± 0.14	2.3 ^{NS} ± 0.23
Average	3.36^{b}±0.29B	4.82^{a}±0.21	3.10^{b}±0.37

Means with different letters in the same row are significantly different, (P<0.05),
NS = not significant, G1 = Group that milked more than 7 months and G2= Group that milked less than 7 months.

Milk composition:

As shown in Table (4), there was a significant difference by 6.24% in milk total solid (TS%) between G1 and G2 and there was a significant difference among the three different stage of lactation in the same group results show that lowest TS% was recoded in late lactation stage in both groups. On the other hand there was a significant difference by 5.86% higher in milk solid not fat (SNF%) between G2 and G1 and there was a significant difference among the three different stage of lactation in the same group results show that lowest SNF% was recoded in late lactation stage in both groups. there was a significant difference in milk fat F (%) by 29.18% between G1 and G2 but there was non-significant difference among the stages. This could be attributed to the inverse relationship between the fat percentage and the amount of milk yield. In addition, the results illustrated that there was non-significant difference in protein (%) between groups but there was a significant deferent in protein (%) among the stages in G1 but there was non-significant difference in protein% among the stages in G2. Results illustrated that was non-significant difference between groups in Ash (%) by 2.60% between G1 and G2, Results illustrated that was non-significant difference between groups in lactose (%) by 25.12% between G2 and G1 and Results illustrated that was non-significant difference between groups in water (%)by 1.19% between G2 and G1, on the other hand there was a significant difference among the three different stage of lactation in the same group. These data were similar to those reported by Gurmessa and Melaku (2012) who found that the percentages of TS in lactating buffaloes were 13.37 % and 12.13 % in early and mid-lactation, respectively. The present data for G1 was higher than that recorded by Seema and Quazi (2014) who found that the percentage of F (%) in milking buffaloes was 6.38%, while the previous studies were in close agreement with the results of G2. Results of lactose content are in agreement with Mahdi (2014) who reported that the maximum concentration of lactose observed during early lactation was 4.53 g/L and decreased significantly to 3.38 g/L at late lactation. Percentages of lactose were higher than those reported by Seema and Quazi (2014), they found that L (%) in lactating buffaloes were 4.19 and 4.21% respectively in early and mid of lactating period. Present result agree with Mahdi (2014) who reported that milk ash of buffalo milk increased significantly at the end of lactation stage compared with the beginning of the lactation stage, the values were (0.84 and 0.71) g/L respectively. Our data was higher than that reported by Seema and Quazi (2014) who found that the percentages of milk ash in lactating buffaloes were 0.64 %, 0.72 % and 0.72% in early, mid and late lactation respectively. Present data was relatively higher than obtained by Mahdi (2014) who found that the milk water percentages at early, mid and late lactation were 81.93 %, 82.01 % and 82.41 %, respectively. these results were agreed with Hency et al (2020) who found that the range of F, SNF and TS from milk samples collected from early, mid, late lactation were 3.8±0.37, 11.47±0.51, and 14.35±0.76 percent, 6.03±0.75, 10.36±0.49 and 16.39±0.90 percent, 4.35±0.69, 10.92±0.5 and 15.2±0.67 percent.

Table 4. Milk components in Egyptian buffalo heifers during the three different stages of lactation (Means ± S.E).

Milk components	Total solids	Sold not fat %	Fat %	Protein %	Ash %	Lactose %	Water %
Group 1							
Early	17.69^{a}±0.31	10.75^{a}±0.16	6.94±0.18	5.58^{a}±0.25	0.73^{b}±0.02	4.44^{b}±0.24	82.31^{b}±0.31
Mid	17.40^{a}±0.19	10.52^{a}±0.12	6.88±0.22	3.76^{b}±0.29	0.79^{a}±0.01	5.96^{a}±0.41	82.60^{b}±0.19
Late	15.44^{b}±0.33	8.40^{b}±0.28	7.04±0.25	5.20^{a}±0.07	0.83^{a}±0.02	2.37^{c}±0.25	84.56^{a}±0.33
Overall	16.84^{A}±0.31	9.89^{B}±0.30	6.95^{A}±0.12	4.85±0.24	0.79±0.01	4.26±0.42	83.16±0.31
Group 2							
Early	16.92^{a}±0.23	11.52^{a}±0.12	5.40^{ab}±0.13	4.34±0.07	0.70^{b}±0.004	6.48^{a}±0.07	83.08^{b}±0.24
Mid	17.34^{a}±0.21	11.64^{a}±0.19	5.70^{a}±0.09	4.18±0.20	0.75^{b}±0.03	6.71^{a}±0.17	82.66^{b}±0.21
Late	13.29^{b}±0.22	8.24^{b}±0.30	5.05^{b}±0.14	4.57±0.02	0.85^{a}±0.01	2.82^{b}±0.31	86.70^{a}±0.22
Overall	15.85^{B}±0.50	10.47^{A}±0.44	5.38^{B}±0.1	4.36±0.08	0.77±0.02	5.33±0.49	84.15±0.50

G1 = Group that milked more than 7 months and G2= Group that milked less than 7 months. ^{a} and ^{b} Means with different superscipts in the same column are significantly different ($P \leq 0.01$),^{A} and ^{B} Means with different superscipts in the same column are significantly different ($P \leq 0.01$).

The correlation coefficients between milk yield and milk composition:

The results presented in Table (5) indicated significant correlation among milk yield and TS (%), fat (%) and water (%). As well as high correlation among milk yield, SNF % and Lactose (%) was observed. The results also showed that there was a high correlation between TS % and each of SNF %, F %, ash (%), lactose (%) and water (%). Highly significant correlation among SNF (%), and Ash (%), lactose % and water (%) was also noticed. In addition results also clarified high correlation among F (%), TS (%) and water (%). On the other hand there was a positive significant correlation between F (%) and protein (%).

Although there was high negative significant correlation between protein % and lactose %. Results also showed that there was a high positive and significant correlation between Ash % and water %. On the other hand, there was a high negative significant correlation between ash % and lactose %. Results showed that there was a high negative significant correlation between lactose % and water %. These results are in agreement with Konig et al. (2006) and Nixon et al (2009) who found that within breed MY was positively correlated to milking frequency.

Table 5. The correlation coefficients between milk yield and milk composition in Egyptian buffalo heifers.

	MY	TS	SNF %	Fat	Protein	Ash	Lactose	Water
Milk yield	1							
TS %	0.635**	1						
SNF %	0.400*	0.841**	1					
Fat %	0.522**	0.478**	0.072	1				
Protein %	0.193	0 .016	0.254	.383*	1			
Ash %	0.031	0.578**	0.707**	0.082	0.138	1		
Lactose %	0.397*	0.698**	0.924**	0.212	-0.605**	-0.655**	1	
Water%	0.635 **	1.000**	0.841**	0.478**	0.016	0.578**	-0.698**	1

***. Correlation is significant at the P ≤0.05 level, **. Correlation is significant at the P ≤0.01 level.**

Insulin like growth factor -1 and prolactin hormones:

Results in Table (6) illustrated that the concentration of IGF-1 (ng/ml) through the lactation stages (early, mid and late lactation) were increased (P≤0.01) steadily with the advancement of lactation in both groups. The difference (P ≤0.01) between the two lactating groups (G1 and G2) was significant. The concentration of IGF-1 was higher in G1 than that in G2 during the three stages of lactation by 21.53 %, 11.53 % and 7.81%, respectively. The present result was in agreement with that of Hassan et al. (2014) who found that the concentration of IGF-1 increased as lactation advanced. Over expression of IGF-1 in the mammary gland led to premature parenchymal development (Su and Cheng, 2004) and delayed involution (Hadsell et al., 1996). IGF-I mRNA was detected in mammary tissue from pregnant and lactating cows (Hauser et al., 1990). Mammary tissue from pregnant heifers was separated into fractions of epithelium, stroma, and blood components and IGF-I m RNA was found to be localized in the stromal component of the mammary gland (Cohick, 1998). IGF-I and IGF-IR were also expressed within both the epithelial and stromal components of the virgin mammary gland (Berry et al. 2001).

Results revealed that the concentration of PRL there was insignificant different among the three stage of lactation in G1, on the other hand there was significant different among the three stage of lactation in G2. Results also revealed that the concentration of PRL was higher in G1 than that in G2 during the three stages of lactation by 2.12 %, 7.9 % and 6.48%, respectively.

The present results are in agreement with Hassan et al. (2014) who reported that serum PRL concentration was little changed during the lactating period in lactating buffaloes. Our results are in agreement with Miller et al. (2006) who observed a significant difference through the lactation stages. They found that PRL concentration was higher in early lactation than at late lactation in buffaloes. The present study suggested that to measure the level of IGF-1 and PRL in heifer blood at the late stage of gestation to be sure that the level of these hormones was around the normal range. If these hormones were less than normal range that will give a good indication that the lactating season will be short or these heifers will not lactate after calving. Blocking the release of PRL during lactogenesis or in early lactation not only produced the negative effects on mammary synthesis of milk but also resulted in an increase in adipose and liver pathways of lipid synthesis as well as reduction in the rates of lipid mobilisation from adipose tissues (Aamrapali, 2021).

Table 6. Hormones concentration (ng/ml) during the three different stages of lactation for lactating in Egyptian buffalo heifers (mean ± S.E).

Groups	IGF-1			Prolactin		
	Stage of lactation					
	Early	**Mid**	**Late**	**Early**	**Mid**	**Late**
G1	$130.84^{b}\pm$ 10.85	$166.04^{a}\pm$ 9.07	$185.04^{a}\pm$ 6.91	190.07 ±3.49	190.92±6.25	182.87±5.60
G2	$107.66^{c}\pm$ 1.53	$148.88^{b}\pm$ 2.69	$171.63^{a}\pm$ 2.94	$186.13^{a}\pm1.72$	$176.94^{b}\pm1.03$	$171.74^{c}\pm0.57$
Average	$119.25^{C}\pm$ 6.45	$157.46^{B}\pm$ 5.3	$178.33^{A}\pm$ 4.18	$188.1^{A}\pm$ 1.95	$183.92^{AB}\pm$ 3.79	$177.31^{B}\pm$ 3.24

G1= Groups that milked more than 7 month, G2= Group that milked less than 7 months[a] and [b] Means with different superscipts in the same row are significantly different (P ≤ 0.01),[A] and [B] Means with different superscipts in the same row are significantly different (P ≤ 0.01).

The correlation between prolactin and milk composition:

There was a positive significant correlation among PRL and T.S %, Fat % and water %. These results agree with Jyotsna and Mahendra (2010) who found that increasing of fat, protein and lactose (%) as observed in this study. The reasons of such short term treatment on milk composition of buffaloes required further investigation as milk composition was influenced by energy balance and mobilization of body reserves.

Table 7. The correlation coefficients between prolactin and milk composition in Egyptian buffalo heifers.

	PRL	TS	SNF %	Fat gl	Protein %	Ash %	Lactose %	Water %

PRL	1							
TS	0.448*	1						
SNF %	0.224	0.841**	1					
Fat %	0.462*	0.478**	0.072	1				
Protein %	0.165	0.016-	0.254	0.383*	1			
Ash %	0.179	0.578**	0.707**	0.082	0.138	1		
Lactose %	0.120	0.698**	0.924**	0.212	0.605**	0655**	1	
Water %	0448*	1.00**	0.841**	0.478**	0.016	0.578**	0.698**	1

***.Correlation is significant at the 0.05 level, **. Correlation is significant at the 0.01 level.**

The correlation between IGF-1 and milk composition:

Results in Table (8). showed the correlation between IGF-1 and milk composition. There was a high positive significant correlation among IGF-1, T.S, SNF, Ash, lactose and water. The present data is in agreement with that of Hassan et al. (2014). They found that the concentration of IGF-1 increased as lactation advanced. Over expression of IGF-1 in the mammary gland led to premature parenchymal development (Su and Cheng, 2004) and delayed involution (Hadsell et al. 1996). Second, IGF-I mRNA was detected in mammary tissue from pregnant and lactating cows (Hauser et al. 1990). Mammary tissue from pregnant heifers was separated into fractions of epithelium, stroma, and blood components and IGF-I m RNA was found to be localized in the stromal component of the mammary gland (Cohick, 1998). IGF-I and IGF-IR were also expressed within both the epithelial and stromal components of the virgin mammary gland (Berry et al., 2001).

Table 8.The correlation coefficients between IGF-1 and milk composition in Egyptian buffalo heifers.

	IGF1	TS	SNF%	Fat %	Protein %	Ash %	Lactose %	Water %
IGF1	1							
TS	0.505**	1						
SNF %	0.702**	0.841**	1					
Fat %	0.209	0.478**	0.072	1				
Protein %	0.002	0.016	0.254	0.383*	1			
Ash %	0.735**	0.578**	0.707**	0.082	0.138	1		
Lactose %	0.586**	0.698**	0.924**	0.212	0.605**	0.655**	1	
Water %	0.505**	01.000**	0.841**	0.478**	0.016	0.578**	0.698**	1

***. Correlation is significant at the 0.05 level .**
****. Correlation is significant at the 0.01 level .**

CONCLUSION

From this study, it shows that IGF-1 and prolactin can be used to predict the milk production and milk composition of buffaloes. There was a high positive significant correlation between milk yield and total solids T.S %, fat % and water %. There was a positive significant correlation among milk yield, S.N.F % and Lactose %. in the two lactating groups (G1 and G2) and it was noticed that the concentration of IGF-1 was higher in G1 than in G2 during the three stages of lactation. PRL concentration in G1 was slightly higher in early and mid-lactation than that in late lactation. There was a positive significant correlation between PRL and T.S, fat and water. There was a high positive significant correlation among IGF-1, T.S, SNF, Ash, lactose and water.

Data summarizing significant result for the effect of lactation stage on milk. The milk yield is decreased in late lactation when compared to Mid and Early lactation. Furthermore fat % is increased significantly during mid lactation than in early and late lactation.

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الملخص العربي

العلاقة بين انتاج اللبن, مكونات اللبن, هرمون الانسولين المشابه لهرمون النمو -1 وهرمون البرولاكتين فى الجاموس المصرى الحلاب

اجريت هذه الدراسة باستخدام عدد عشرين من رؤوس الجاموس المصرى الحلاب حيث تم إيوائها فى حظائر ذات النظام المفتوح تحت نفس نظم التغذية والظروف البيئية. تم تقسيم الجاموس الى مجموعتين فى نهاية موسم الحليب الاول طبقأ الى طول موسم انتاج اللبن. المجموعة الاولى هى التى تجاوز طول موسم الحلابة 7 اشهر بمتوسط (225 يوم) بينما الاخرى لم يتجاوز طول موسم الحلابة بها 7 اشهر بمتوسط (175يوم).

تم جمع عينات اللبن مرة اسبوعيا من كل جاموسة حلابة عند الساعة 6 صباحاً و6 مساء ثم تم خلطهما معأ. تم قياس كل من هرمون البرولاكتن وهرمون الانسولين المشابه لهرمون النمو -1 أثناء موسم انتاج اللبن. كان هناك اختلافات معنوية فى قياسات الهرمونات بين المجموعة الاولى والثانية ولكن لم تكن هناك اختلافات معنوية بين المراحل المختلفة لموسم أنتاج اللبن كما سجل نفس الاتجاه فى نتائج نسبة الدهن فى اللبن. بينما كان هناك اختلافات معنوية فى النسبة المئوية للجوامد الكلية الغير دهنية فى المراحل المختلفة لموسم انتاج اللبن.

كان هناك ارتباط معنوى ايجابى قوى بين انتاج اللبن والنسبة المئوية للجوامد الكلية والنسبة المئوية للدهن والنسبة المئوية للماء ياللبن. كان هناك ارتباط معنوى ايجابى بين أنتاج اللبن والنسبة المئوية للجوامد الكلية الغير دهنية و اللاكتوز فى كلا المجموعتين كما سجلت ان تركيز هرمون الانسولين المشابه لهرمون النمو -1. كان مرتفع فى المجموعة الاولى عنه فى المجموعة الثانية خلال المراحل الثلاثة من موسم انتاج اللبن بمعدل 40.21% و 22.35% و 12.86% على التوالى. كان تركيز هرمون البرولاكتن مرتفع قليلا فى المجموعة الاولى فى المرحلتين المبكرة والوسطى من مراحل انتاج البن عنه فى المرحلة المتاخرة من موسم أنتاج اللبن. كان هناك ارتباط معنوى أيجابى بين هرمون البرولاكتن و النسبة المئوية للجوامد الكلية و نسبة الدهن والنسبة المئوية للماء فى اللبن. كان هناك ارتباط معنوى أيجابى قوى بين هرمون الانسولين المشابه لهرمون النمو -1 و النسبة المئوية للجوامد الكلية و النسبة المئوية للجوامد الكلية الغير دهنية والنسبة المئوية للرماد و النسبة المئوية للاكتوز والنسبة المئوية للماء.

الكلمات الدالة : الجاموس المصرى، هرمون الانسولين المشابه لهرمون النمو -1، البرولاكتين، إنتاج اللبن ومكوناته, مرحلة الحليب.